

**MONITORING SUMMARY AND TORNADO DAMAGE ASSESSMENT  
FOR MANLEY WOODS  
WILSON'S CREEK NATIONAL BATTLEFIELD**

September 15, 2003

Alicia N. Sasseen  
Ecologist



Prairie Cluster Prototype Long-Term Ecological Monitoring Program  
National Park Service

## Table of Contents

List of Figures .....	iii
Background .....	1
Current Disturbances .....	1
Sample Methods.....	2
Damage Assessment .....	2
Management Implications.....	3
Literature Cited .....	4
Appendix A Ground Flora Vegetation 1998-2003 .....	13

## List of Figures

Figure 1 Map of Wilson's Creek National Battlefield showing 4 May 2003 tornado damage. ....	6
Figure 2 Plot design featuring 10 permanent 10m <sup>2</sup> plots for monitoring herbaceous species and tree species regeneration on paired transects creating a 20m x 50m macroplot for overstory and understory tree species data collection.....	7
Figure 3 Manley Woods site 7 without tornado damage. ....	8
Figure 4 Manley Woods site 4 after the 4 May 2003 tornado. ....	9
Figure 5 Change in overstory and understory (trees > 5cm dbh) density and basal area. ....	10
Figure 6 Change in dominant overstory species (>15cm dbh). ....	10
Figure 7 Density of regeneration layer, 1998-2003. ....	11
Figure 8 Change in relative cover of ground flora guilds. ....	11
Figure 9 Change in species composition and number of seedlings for total sample area (400m <sup>2</sup> ). ....	12
Figure 10 Decrease in numbers of species per total sample site (400m <sup>2</sup> ) and increase in percent exotics. ....	12

## Background

Prior to European settlement, nearly one-third of Missouri was covered by savanna. Wilson's Creek National Battlefield (WICR), at the ecotone of the eastern deciduous forest and the western prairie, was described in 1819 by Schoolcraft as being "covered by [a] large growth of forest trees and cane, and interspersed with prairies" (Park 1955). Shortly after, Civil War soldiers described the area as having: "few trees [that] were rather large, scrawling, and straggling, and everything could be distinctly seen under them all around" (Ware 1907).

In subsequent years, with the suppression of fire, the savanna areas of WICR have become overgrown with woody vegetation. With the use of prescribed fire, management at WICR has aimed at restoring these areas to the more open savanna-like conditions seen during pre-settlement conditions. Restoration of these areas in the park will not only enhance interpretation of the battlefield, but will return the historic disturbance regime under which the local vegetation adapted. Through the reintroduction of historic disturbance regimes the diversity of plant species can be maintained (Ladd 1991).

However, the use of prescribed fire as a management tool in the wooded areas of WICR has not been highly successful. The area of Manley Woods was burned at low intensity in the fall of 1997, but has failed to burn in successive years. Increased canopy cover has resulted in more mesic conditions making it difficult for fire to carry through these areas. The mesic conditions, resulting from 50+ years of fire suppression, have changed the understory from a "sea of prairie grasses" to a community dominated by herbaceous forb and woody species (Ladd 1991).

## Current Disturbances

On 4 May 2003, a tornado touched down in the southern portion of WICR resulting in 60 ha of damage (fig. 1). Damaged areas included the Manley Woods section of WICR containing four permanent monitoring sites of the Prairie Cluster Long-Term Ecological Monitoring Program (PC-LTEM). These sites had been previously sampled in 1997, 1998 and 2000.

Catastrophic windstorms, such as tornadoes, profoundly alter the structure and composition of forest ecosystems (Harrington and Bluhm 2001, Held *et al.* 1998, Liu *et al.* 1997). Forest disturbances, such as windstorms, cause temporary decreases in plant abundance and size that can release resources formerly monopolized by pre-disturbance vegetation (Bormann and Likens 1979).

Forest disturbances also create a more spatially heterogeneous environment by altering colonization microsites for plant species. Altering the size, type and frequency of colonization sites can result in higher diversity after disturbance (Harrington *et al.* 2001). However, large-scale disturbances can also result in the introduction of less desirable species into forest ecosystems.

## Sample Methods

Herbaceous species frequency and foliar cover measures were collected at four spatial scales in ten, permanent plots per monitoring site (Fig. 2). The number of seedlings and saplings was tallied in each 10m<sup>2</sup> plot per site. Species and diameter at breast height (dbh) of all overstory trees (>5cm dbh) was recorded in the 20m x 50m macroplot (Fig. 2). A detailed description of sampling methods and community summary variables is provided in *Protocol Design for Plant Community Monitoring* (Willson *et al.* 2002).

## Damage Assessment

The presence of permanent PC-LTEM sampling sites in Manley Woods allows for a unique opportunity to quantify the effects of tornado damage on the vegetation community and subsequent successional trends. To assess the damage to vegetation and to monitor change after the tornado, the four sites were re-sampled in the summer months following the May 4<sup>th</sup> tornado.

Vegetation structure and composition are often indicators of site quality and are critical in addressing many other ecological characteristics such as wildlife habitats, nutrient cycling, hydrologic regimes, soils, and air quality. Furthermore, changes in herbaceous species composition can provide a sensitive measure of ecologically relevant changes in the environment (Phillipi *et al.* 1998, Rowe 1956, Daubenmire 1952). Plants integrate many important environmental factors, most of which are difficult to directly measure (Meilleur *et al.* 1992).

High winds resulted in significant damage to the Manley Woods area of WICR. Numerous trees were uprooted, topped or boles snapped (fig. 3 & 4). Large amounts of downed woody debris littered the ground. Density (number of trees) of overstory and understory trees (trees >5cm dbh) decreased by 37% from 1997 (fig. 5). As would be expected, the canopy dominants white oak (*Quercus alba*), post oak (*Quercus stellata*) and black oak (*Quercus velutina*) were most affected by the tornado due to their large size (fig. 6). In the future, overstory density may continue to decline as trees that were damaged, but still alive, continue to die.

Measuring the regeneration layer of the forest allows us to predict the future composition of the overstory. Overall, total regeneration has not increased (fig. 6) from previous years, but species composition has shifted (fig. 7). Red elm (*Ulmus rubra*) was the major component in the seedling regeneration layer in 1998 and 2000 and was still dominant in 2003. However, in 2003 the shade intolerant eastern red cedar (*Juniperus virginiana*) increased by 57 % (fig. 7). Meanwhile, the oak component of the regeneration layer has continued to decline over the years. Research in the Allegheny National Forest of Pennsylvania showed initial increases in regeneration one year after tornado damage, but with subsequent decreases in following years (Peterson and Pickett 1995). It is too early to determine how regeneration of woody species in Manley Woods will respond to the tornado damage. Data from 2003 will serve as a baseline to compare future observations.

In addition to the woody layers, the herbaceous ground flora was also measured. The composition of the ground flora community at Manley Woods has changed since it was first measured in 1998. Total richness (number of species) has decreased from previous years, while exotics have continued to increase (fig. 8). Guild dominance has shifted to increasing cover by woody shrub and vine species, indicative of more mesic conditions (fig. 9). Grasses (both warm- and cool-season) are still a small component of the ground flora community.

## **Management Implications**

In future management of Manley Woods, prescribed burning may be necessary to reduce the eastern red cedar component, which is problematic in other areas of the park. Prescribed burning may also be necessary to control the spread of exotic species such as multiflora rose (*Rosa multiflora*) and Japanese honeysuckle (*Lonicera japonica*) (Appendix A, tables 3b). However, the increase in woody debris creates a large fuel load that must be considered in future fire plans. Manual reduction of fuel loads may be necessary before initiating prescribed burning. Ultimately, a fire operations specialist will need to be consulted to determine safe conditions.

The decrease in canopy cover as a result of the tornado is consistent with the goal of savanna restoration at Manley Woods. The area is now more similar to the historic landscape as a result of the tornado; however, without subsequent management the opportunity may be lost. Without management intervention, natural forest succession will proceed at Manley Woods. In response to increased light levels, initial successional stages will be dominated by the proliferation of shade intolerant species such as eastern red cedar (Dyer and Baird 1997, Peterson and Rebertus 1997). In later successional stages, deciduous trees, such as red elm and hackberry, may form a closed canopy environment over the eastern red cedar causing its eventual decline. Though shade intolerant, eastern red cedar is able to remain in the understory for several decades before dying out.

Without fire, Manley Woods will ultimately become a more mesic, closed canopy forest than was present in the historical landscape. Oak species will continue to decline as will warm season grass cover. Additional monitoring will be needed to quantify the response of the vegetation community in future years and the effects of subsequent management decisions.

## Literature Cited

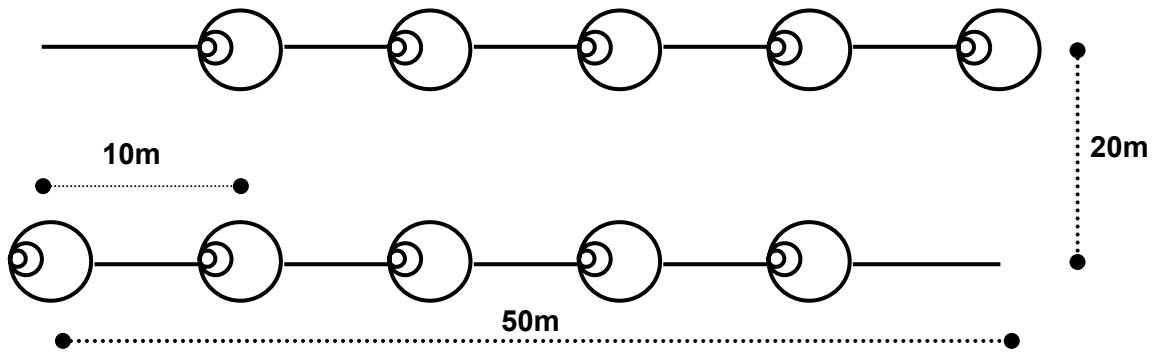
- Barnes, B.V., D.R. Zak, S.R. Denton and S.H. Spurr. 1980. Forest ecology. John Wiley & Sons, Inc. 774 pp.
- Bormann, F.H. and G.E. Likens. 1979. Pattern and process in a forested ecosystem. Springer-Verlag, 253 pp.
- Daubenmire, R. 1952. Forest vegetation of northern Idaho and adjacent Washington and its bearings on concepts of vegetation classification. Ecological Monographs 22:301-330.
- Dyer, J.M. and P.R. Baird. 1997. Wind disturbance in remnant forest stands along the prairie-forest ecotone, Minnesota, USA. Plant Ecology 129:121-134.
- Gremaud, G. 1986. Wilson's Creek National Battlefield: A plan for the restoration of the historic vegetation. Missouri Department of Conservation
- Held, M.E., S. Jones-Held and J.E. Winstead. 1998. Forest community structure and tornado damage in an old-growth system in northern Kentucky. Castanea 63:474-481.
- Harrington, T.B. and A.A. Bluhm. 2001. Tree regeneration responses to microsite characteristics following a severe tornado in the Georgia Piedmont, USA. Forest Ecology and Management 140:265-275.
- Ladd, D. 1991. Reexamination of the role of fire in the Missouri oak woodlands. Proceedings of the Oak Woods Management Workshop, Eastern Illinois University, Charleston, IL pp. 67-80.
- Liu, C., J.S. Glitzenstein, P.A. Harcombe and R.G. Knox. 1997. Tornado and fire effects on tree species composition in a savanna in the Big Thicket National Preserve, southeast Texas, USA. Forest Ecology and Management 91:279-289.
- Meilleur, A., A. Bouchard and Y. Bergeron. 1992. The use of understory species as indicators of landform ecosystem type in heavily disturbed forest: an evaluation in the Haut-Saint-Laurent, Quebec. Vegetatio 102:13-32.
- Park, H. 1955. Schoolcraft in the Ozarks, Reprint of Journal of a Tour into the Interior of Arkansas in 1818 and 1819. Van Buren
- Peterson, C.J. and S.T.A. Pickett. 1995. Forest reorganization: A case study in an old-growth forest catastrophic blowdown. Ecology 76:763-774.

- Peterson, C.J. and A.J. Rebertus. 1997. Tornado damage and initial recovery in three adjacent, lowland temperate forests in Missouri. *Journal of Vegetation Science* 8:559-564.
- Phillippi, T.E., P.M. Dixon and B.E. Taylor. 1998. Detecting trends in species composition. *Ecological Applications* 8:300-308.
- Putz, F.E. 1983. Treefall pits and mounds, buried seeds, and the importance of soil disturbance to pioneer trees on Barro Colorado Island, Panama. *Ecology* 64:1069-1074.
- Rowe, J.S. 1956. The use of undergrowth plant species in forestry. *Ecology* 37:461-473.
- Ware, E.F. 1907. The Lyon Campaign in Missouri: Being a brief history of the First Iowa Infantry. Topeka
- Willson, G.D., L.P. Thomas, M. DeBacker, W.M. Rizzo and C. Buck. 2002. Plant community monitoring protocol for six prairie parks. United States Geological Service/National Park Service, 40pp.





**Figure 1 Map of Wilson's Creek National Battlefield showing 4 May 2003 tornado damage.**



**Figure 2 Plot design featuring 10 permanent 10m<sup>2</sup> plots for monitoring herbaceous species and tree species regeneration on paired transects creating a 20m x 50m macroplot for overstory and understory tree species data collection.**



**Figure 3 Manley Woods site 7 without tornado damage.**





**Figure 4 Manley Woods site 4 after the 4 May 2003 tornado.**

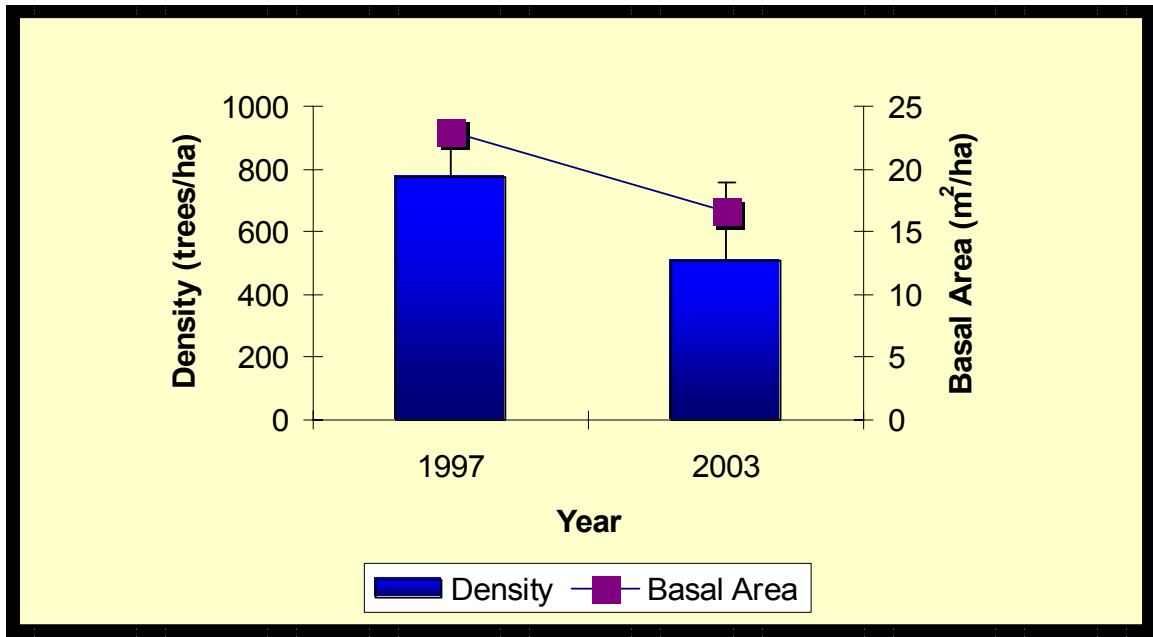


Figure 5 Change in overstory and understory (trees > 5cm dbh) density and basal area.

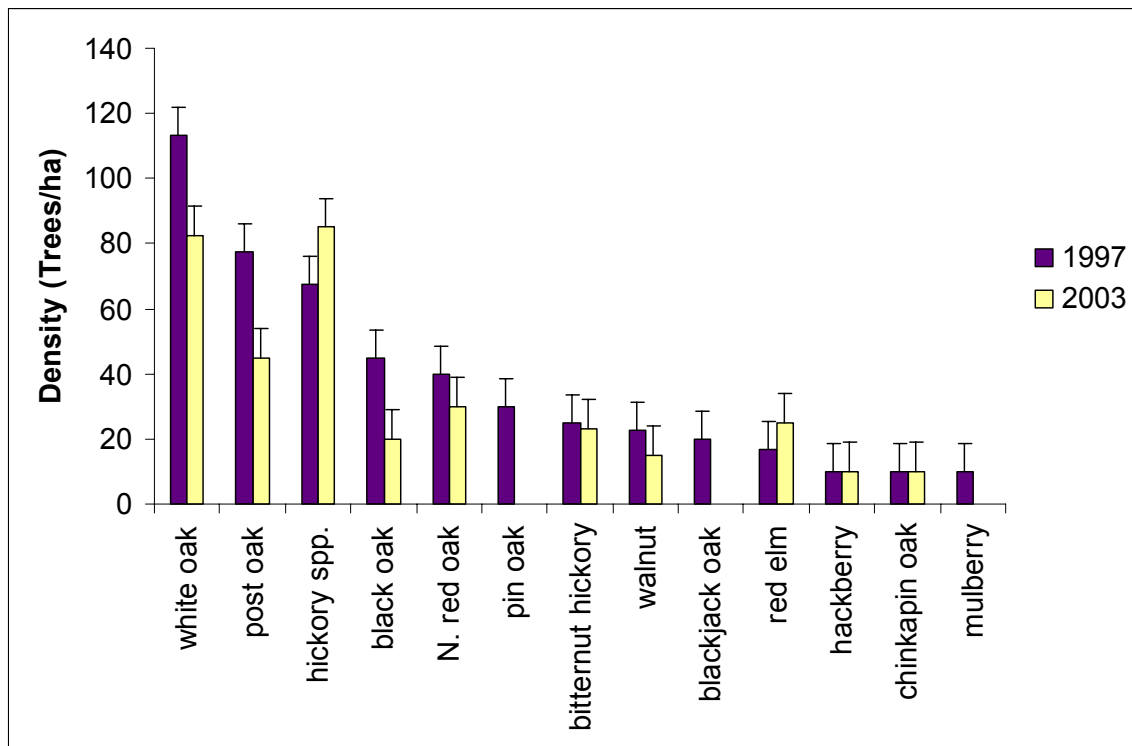


Figure 6 Change in dominant overstory species (>15cm dbh).

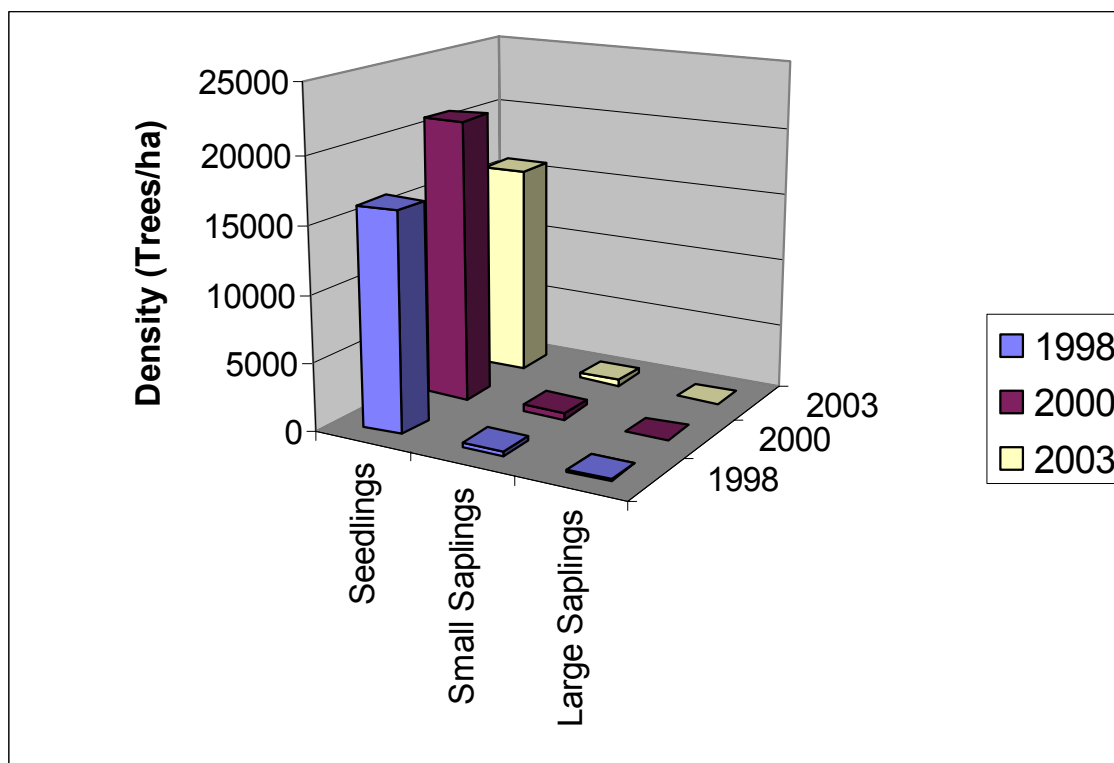


Figure 7 Density of regeneration layer, 1998-2003.

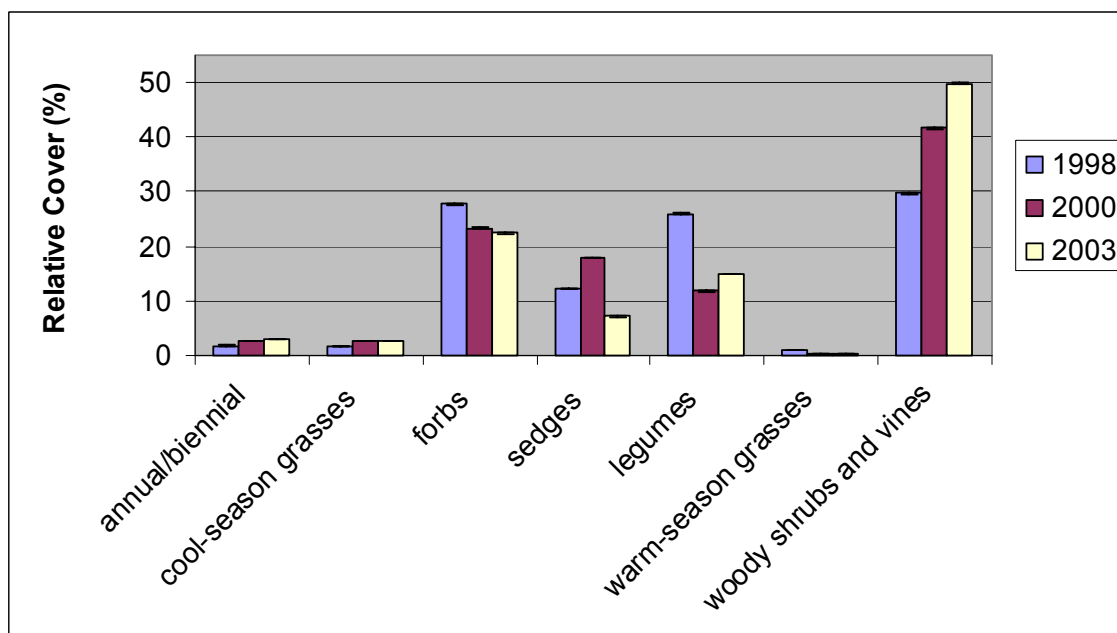


Figure 8 Change in relative cover of ground flora guilds.

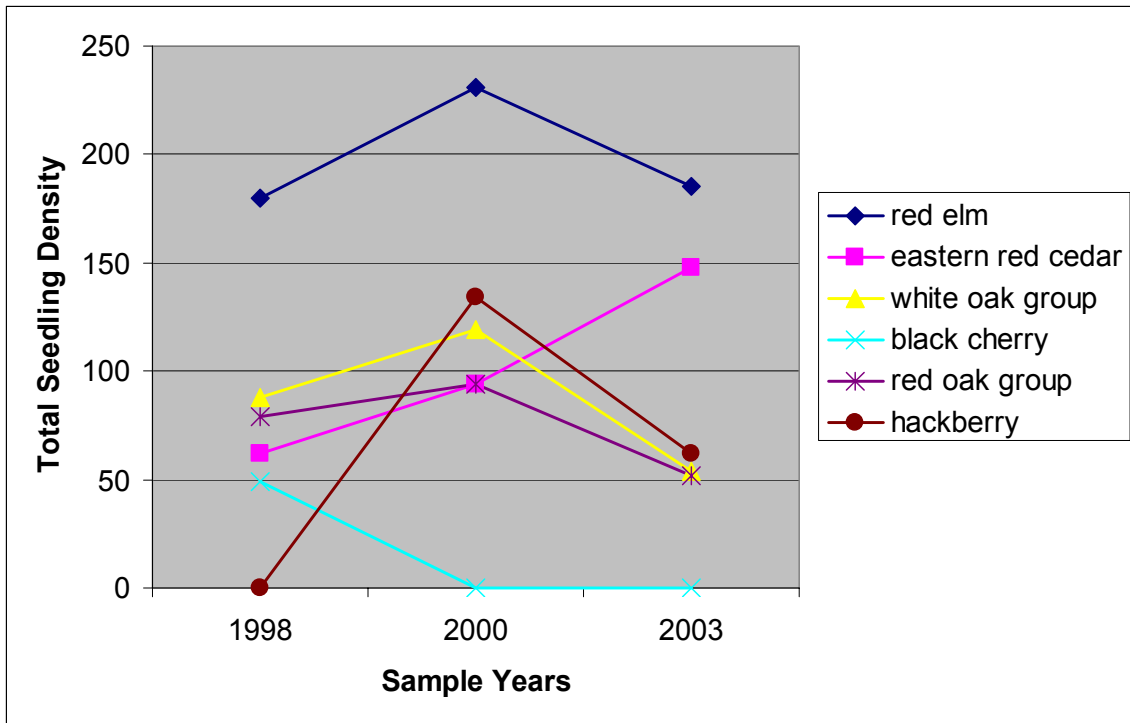


Figure 9 Change in species composition and number of seedlings for total sample area (400m<sup>2</sup>).

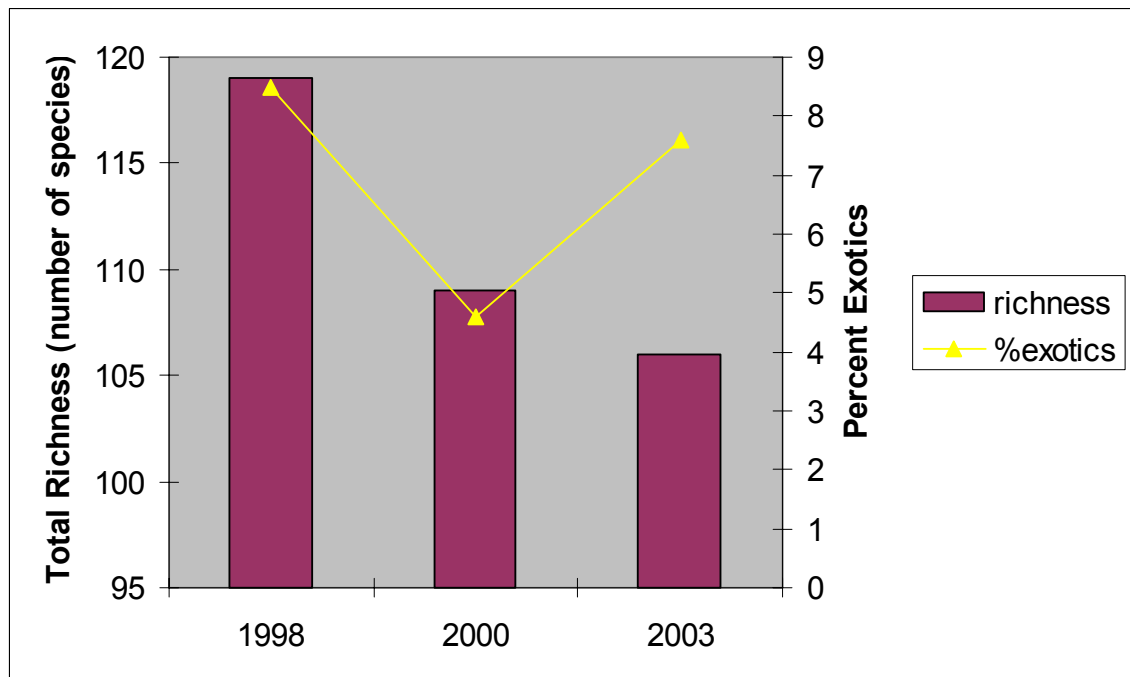


Figure 10 Decrease in numbers of species per total sample site (400m<sup>2</sup>) and increase in percent exotics.

## Appendix A Ground Flora Vegetation 1998-2003

### 1998 Manley Woods Ground Flora Vegetation

**Table 1a. Plant Community Composition: Species Richness and Shannon Diversity.**

All Species:

Species Richness:	<b>119</b>	Total Shannon Evenness:	<b>0.69</b>
Total Shannon Diversity:	<b>3.28</b>	Mean Evenness (st dev):	<b>0.71 (0.02)</b>
Mean Diversity (st dev):	<b>2.97 (0.13)</b>		

Native Species Only:

Native Species Richness:	<b>108</b>	Total Shannon Evenness:	<b>0.69</b>
Total Shannon Diversity:	<b>3.24</b>	Mean Evenness (st dev):	<b>0.71 (0.02)</b>
Mean Diversity (st dev):	<b>2.93 (0.11)</b>		

**Table 1b. Plant Community Summary: Relative Frequency and Cover of Exotic Species.**

Number of Exotic Species: **10**

Number of Native Species: **108**

Exotic Ratio: **0.085**

	<u>Mean Relative Frequency</u>	<u>Mean Relative Cover</u>
Exotic	<b>2.87%</b>	<b>0.84%</b>
Native	<b>97.13%</b>	<b>99.16%</b>

**Table 1c. Plant Community Composition: Relative Frequency and Cover of Plant Guilds.**

<u>Plant Guild</u>	<u>Mean Relative Cover (st dev)</u>	<u>Mean Relative Frequency (st dev)</u>
Annuals and Biennials	<b>1.81% (0.014)</b>	<b>7.27% (0.035)</b>
Cool-Season Grasses	<b>1.57% (0.010)</b>	<b>5.52% (0.025)</b>
Ephemeral Spring Forbs	<b>4.98% (0.046)</b>	<b>4.83% (0.018)</b>
Ferns	<b>0.18% (0.001)</b>	<b>0.85% (0.005)</b>
Grass-Like	<b>12.29% (0.064)</b>	<b>4.25% (0.005)</b>
Legumes	<b>25.92% (0.139)</b>	<b>11.12% (0.021)</b>
Spring Forbs	<b>5.29% (0.019)</b>	<b>19.78% (0.019)</b>
Summer/Fall Forbs	<b>17.23% (0.020)</b>	<b>21.48% (0.035)</b>
Warm-Season Grasses	<b>1.07% (0.011)</b>	<b>1.68% (0.003)</b>
Woody Species	<b>29.66% (0.101)</b>	<b>23.22% (0.057)</b>



**Table 2a. Plant Community Structure: Ground Cover.**

<u>Structural Component</u>	<u>Mean Percent Cover</u>
BARE SOIL	<b>12.43</b>
BARE ROCK	<b>23.01</b>
GRASS LITTER	<b>1.44</b>
WOODY DEBRIS	<b>13.13</b>
LEAF LITTER	<b>36.13</b>
UNVEGETATED SURFACE	<b>66.06</b>

**Table 2b. Plant Community Structure: Vegetation Type Cover.**

<u>Vegetation Type</u>	<u>Mean Percent Cover</u>
Grasses/Grass-Like	<b>8.94</b>
Herbs	<b>31.89</b>
Shrubs	<b>10.80</b>
Woody Vines	<b>6.49</b>

**Table 3a. Plant Community Composition: Herbaceous and Shrub Species.**

<b>Species</b>	<b>Common Name</b>	<b>Frequency</b>	<b>Mean Cover</b>	<b>Importance Value</b>
AMPHICARPA BRACTEATA	Hog-peanut	87.50%	10.57	0.0984
CAREX SPP		100.00%	7.26	0.0815
PARTHENOCISSUS QUINQUEFOLIA	Virginia-creeper, woodbine	97.50%	5.18	0.0635
SYMPHORICARPOS ORBICULATUS	Coralberry	85.00%	4.37	0.0482
RUBUS SPP		50.00%	7.28	0.0419
AGERATINA ALTISSIMA	Tall ageratina	60.00%	5.38	0.0394
DESMODIUM OBTUSUM	Tick-trefoil	52.50%	5.29	0.0344
PODOPHYLLUM PELTATUM	May-apple, mandrake	47.50%	4.47	0.0297
VITIS SPP		87.50%	1.00	0.0257
RHUS AROMATICA	Squaw-bush	35.00%	6.21	0.0251
AGRIMONIA PUBESCENS	Downy agrimony, harvest	67.50%	1.69	0.0244
DESMODIUM GLUTINOSUM	Cluster-leaf tick-trefoil	45.00%	2.94	0.0218
RIBES MISSOURIENSE	Missouri gooseberry	57.50%	1.57	0.0209
PHRYMA LEPTOSTACHYA	Lopseed	65.00%	0.98	0.0197
ELEPHANTOPUS CAROLINIANUS	Leafy elephant's foot	27.50%	5.36	0.0172
GEUM CANADENSE	White avens	67.50%	0.50	0.0166
THALICTRUM THALICTROIDES	Meadow-rue	60.00%	0.92	0.0165
GALIUM CONCINNUM	Bedstraw, cleavers	47.50%	1.66	0.0163
ACALYPHA VIRGINICA	Virginia copperleaf	62.50%	0.50	0.0156
GALIUM PILOSUM	Beadstraw, Cleavers	60.00%	0.60	0.0155
DESMODIUM ROTUNDIFOLIUM	Round-leaved tick-trefoil	30.00%	3.33	0.0146
HELIANTHUS HIRSUTUS	Hairy sunflower	27.50%	3.41	0.0139
VIOLA SORORIA	Violet	52.50%	0.50	0.0126
DICHANTHELIUM VILLOSISSIMUM	Panic grass	45.00%	0.78	0.0120
VAR. VILLOSISSIMUM				
VIOLA PALMATA VAR. TRILOBA	Wood violet	47.50%	0.50	0.0117
SMILAX TAMNOIDES	Catbrier	40.00%	0.66	0.0105

<b>Species</b>	<b>Common Name</b>	<b>Frequency</b>	<b>Mean Cover</b>	<b>Importance Value</b>
OXALIS VIOLACEA	Violet wood-sorrel	42.50%	0.50	0.0104
MUHLENBERGIA SCHREBERI	Nimblewill	25.00%	2.20	0.0101
SANICULA CANADENSIS	Canada sanicle	30.00%	1.13	0.0088
SOLIDAGO ULMIFOLIA	Elm-leaved goldenrod	25.00%	1.50	0.0085
MONARDA RUSSELIANA	Bee-balm	22.50%	2.11	0.0083
VERNONIA BALDWINII	Western ironweed	32.50%	0.69	0.0080
PHYSALIS VIRGINIANA	Virginia ground cherry	32.50%	0.50	0.0079
PRENANTHES ALTISSIMA	Tall white lettuce	32.50%	0.50	0.0078
AMBROSIA ARTEMISIIFOLIA	Common ragweed	32.50%	0.50	0.0076
CONVOLVULUS ARVENSIS	Field-bindweed	30.00%	0.50	0.0074
VIBURNUM RUFIDULUM	Southern black haw	27.50%	0.50	0.0070
ARISTOLOCHIA SERPENTARIA	Snakeroot	25.00%	0.50	0.0063
GERANIUM MACULATUM	Wild geranium	20.00%	0.81	0.0060
DICHANTHELIUM OLIGOSANTHES	Panic grass	25.00%	0.50	0.0060
OXALIS SPP	wood-sorrel	25.00%	0.50	0.0057
AGRIMONIA ROSTELLATA	Woodland agrimony,	7.50%	5.33	0.0056
DANTHONIA SPICATA	Poverty oatgrass	17.50%	0.86	0.0047
CELASTRUS SCANDENS	American bittersweet	17.50%	0.50	0.0044
LESPEDEZA VIRGINICA	Virginia lespedeza	17.50%	0.50	0.0043
FESTUCA SUBVERTICILLATA	Nodding fescue	17.50%	0.50	0.0040
LESPEDEZA PROCUMBENS	Downy trailing lespedeza	15.00%	0.92	0.0039
VERBESINA ALTERNIFOLIA	Wingstem	12.50%	0.50	0.0034
BOTRYCHIUM VIRGINIANUM	Rattlesnake-fern	12.50%	0.50	0.0034
RANUNCULUS ABORTIVUS	Small-flowered crowfoot	12.50%	0.50	0.0033
BROMUS PUBESCENS	Brome, Brome-grass, Chess,	12.50%	0.50	0.0032
ASTER PATENS	Clasping wild aster	12.50%	0.50	0.0031
AMORPHA CANESCENS	Lead-plant	12.50%	0.50	0.0031
EUPHORBIA COROLLATA	Flowering spurge	12.50%	0.50	0.0031
LACTUCA CANADENSIS	Tall lettuce	12.50%	0.50	0.0030
POTENTILLA SIMPLEX	Old-field five-fingers	12.50%	0.50	0.0030
POA PRATENSIS	Kentucky bluegrass	10.00%	1.13	0.0028
TRIOSTEUM PERFOLIATUM	Perfoliate horse-gentian	12.50%	0.50	0.0027
CIRSIIUM ALTISSIMUM	Tall thistle	12.50%	0.50	0.0027
MENISPERMUM CANADENSE	Moonseed	10.00%	0.50	0.0026
TAENIDIA INTEGERRIMA	Yellow pimpernel	10.00%	0.50	0.0024
SOLIDAGO PETIOLARIS	Goldenrod	7.50%	1.33	0.0023
TRADESCANTIA THARPII	Spiderwort	10.00%	0.50	0.0023
TARAXACUM OFFICINALE	Common dandelion	10.00%	0.50	0.0023
HOUSTONIA PURPUREA	Mountain houstonia	7.50%	0.50	0.0021
SIDEROXYLON LANUGINOSUM SSP. ALBICANS	Carolina Gum	7.50%	0.50	0.0021
DESMODIUM PANICULATUM	Tick-trefoil	5.00%	3.00	0.0021
LONICERA JAPONICA	Japanese honeysuckle	5.00%	1.75	0.0020
VERBENA URTICIFOLIA	White vervain	7.50%	0.50	0.0020
THASPIUM BARBINODE	Bearded meadow-parsnip	7.50%	0.50	0.0019
HIERACIUM GRONOVII	Beaked hawkweed	7.50%	0.50	0.0019
LESPEDEZA REPENS	Creeping lespedeza	7.50%	0.50	0.0018
KRIGIA BIFLORA	Orange dwarf dandelion	7.50%	0.50	0.0018
ALLIUM CANADENSE	Onion	7.50%	0.50	0.0018

<b>Species</b>	<b>Common Name</b>	<b>Frequency</b>	<b>Mean Cover</b>	<b>Importance Value</b>
ANTENNARIA PLANTAGINIFOLIA	Plantain pussytoes	5.00%	1.75	0.0018
TRIDENS FLAVUS	Purpletop	7.50%	0.50	0.0016
DICHANTHELIUM MALACOPHYLLUM	Panic grass	7.50%	0.50	0.0016
ASPLENIUM PLATYNEURON	Ebony spleenwort	7.50%	0.50	0.0016
TRIODANIS PERFOLIATA	Round-leaved triodanis	7.50%	0.50	0.0016
DIOSCOREA VILLOSA	Colic-root	5.00%	0.50	0.0014
ERECTITES HIERACIIFOLIA	Fireweed	5.00%	0.50	0.0014
ROSA SETIGERA	Climbing prairie rose	5.00%	0.50	0.0014
DESMODIUM NUDIFLORUM	Naked tick-trefoil	5.00%	0.50	0.0014
DICHANTHELIUM CLANDESTINUM	Panic grass	2.50%	3.00	0.0013
RANUNCULUS HISPIDUS	Hispid buttercup	5.00%	0.50	0.0013
BOEHMERIA CYLINDRICA	False nettle	5.00%	0.50	0.0013
ELYMUS VIRGINICUS	Virginia wild rye	5.00%	0.50	0.0012
ASTER TURBINELLUS	Prairie wild aster	5.00%	0.50	0.0012
ANDROPOGON VIRGINICUS	Broom-sedge	5.00%	0.50	0.0012
BIDENS BIPINNATA	Spanish Needles	5.00%	0.50	0.0011
STELLARIA MEDIA	Common chickweed	5.00%	0.50	0.0011
SCUTELLARIA PARVULA	Little skullcap	5.00%	0.50	0.0011
ROSA CAROLINA	Pasture rose	2.50%	3.00	0.0010
TOXICODENDRON RADICANS	Common poison-ivy	2.50%	3.00	0.0010
AMBROSIA TRIFIDA	Giant ragweed	2.50%	0.50	0.0007
CLAYTONIA VIRGINICA	Spring-beauty	2.50%	0.50	0.0007
TRIFOLIUM CAMPESTRE	Pinnate hop-clover	2.50%	0.50	0.0007
CRATAEGUS SPP		2.50%	0.50	0.0007
RUDBECKIA TRILOBA	Three-lobed coneflower	2.50%	0.50	0.0007
GALIAM ARKANSANUM	Bedstraw, cleavers	2.50%	0.50	0.0007
FRAGARIA VIRGINIANA	Thick-leaved wild	2.50%	0.50	0.0007
PHYTOLACCA AMERICANA	Pokeweed, pokeberry	2.50%	0.50	0.0007
ANDROPOGON GERARDII	Big bluestem	2.50%	0.50	0.0006
TRILLIUM SESSILE	Toadshade	2.50%	0.50	0.0006
ROSA MULTIFLORA	Multiflora rose	2.50%	0.50	0.0006
ANEMONE VIRGINIANA	Tall anemone, thimbleweed	2.50%	0.50	0.0006
LACTUCA SERRIOLA	Prickly lettuce	2.50%	0.50	0.0006
BROMUS RACEMOSUS	Brome, Brome-grass, Chess,	2.50%	0.50	0.0006
CARDAMINE CONCATENATA	Five-parted toothwort	2.50%	0.50	0.0006
CEANOETHUS AMERICANUS	New Jersey tea, redroot	2.50%	0.50	0.0006
ACALYPHA GRACILENS VAR. MONOCOCCA	Ozarkian short-stalk	2.50%	0.50	0.0006
GALIAM OBTUSUM	Bluntleaf bedstraw	2.50%	0.50	0.0006
GALIAM CIRCAEZANS	Forest bedstraw, wild	2.50%	0.50	0.0006
CONYZA CANADENSIS	Horseweed	2.50%	0.50	0.0005
CROTON GLANDULOSUS	Tooth-leaved croton	2.50%	0.50	0.0005
HEDYOTIS NIGRICANS VAR. NIGRICANS	Madder	2.50%	0.50	0.0005
POLYGONUM SPP		2.50%	0.50	0.0005
ELYMUS VILLOSUS	Downy wild rye	2.50%	0.50	0.0005
CERASTIUM PUMILUM	Mouse-ear chickweed	2.50%	0.50	0.0005

**Table 3b. Plant Community Composition: Exotic Species.**

<b>Species</b>	<b>Common Name</b>	<b>Frequency</b>	<b>Mean Cover</b>	<b>Importance Value</b>
CONVOLVULUS ARVENSIS	Field-bindweed	30.00%	0.50%	0.0074
POA PRATENSIS	Kentucky bluegrass	10.00%	1.13%	0.0028
TARAXACUM OFFICINALE	Common dandelion	10.00%	0.50%	0.0023
LONICERA JAPONICA	Japanese honeysuckle	5.00%	1.75%	0.0020
STELLARIA MEDIA	Common chickweed	5.00%	0.50%	0.0011
TRIFOLIUM CAMPESTRE	Pinnate hop-clover	2.50%	0.50%	0.0007
ROSA MULTIFLORA	Multiflora rose	2.50%	0.50%	0.0006
LACTUCA SERRIOLA	Prickly lettuce	2.50%	0.50%	0.0006
BROMUS RACEMOSUS	Brome, Brome-grass, Chess,	2.50%	0.50%	0.0006
CERASTIUM PUMILUM	Mouse-ear chickweed	2.50%	0.50%	0.0005

## 2000 Manley Woods Ground Flora Vegetation

**Table 1a. Plant Community Composition: Species Richness and Shannon Diversity.**

All Species:

Species Richness:	<b>109</b>	Total Shannon Evenness:	<b>0.66</b>
Total Shannon Diversity:	<b>3.09</b>	Mean Evenness (st dev):	<b>0.70 (0.10)</b>
Mean Diversity (st dev):	<b>2.88 (0.33)</b>		

Native Species Only:

Native Species Richness:	<b>103</b>	Total Shannon Evenness:	<b>0.66</b>
Total Shannon Diversity:	<b>3.05</b>	Mean Evenness (st dev):	<b>0.70 (0.10)</b>
Mean Diversity (st dev):	<b>2.85 (0.36)</b>		

**Table 1b. Plant Community Summary: Relative Frequency and Cover of Exotic Species.**

Number of Exotic Species: **5**

Number of Native Species: **103**

Exotic Ratio: **0.046**

	<u>Mean Relative Frequency</u>	<u>Mean Relative Cover</u>
Exotic	<b>2.07%</b>	<b>0.79%</b>
Native	<b>97.93%</b>	<b>99.21%</b>

**Table 1c. Plant Community Composition: Relative Frequency and Cover of Plant Guilds.**

<u>Plant Guild</u>	<u>Mean Relative Cover (st dev)</u>	<u>Mean Relative Frequency (st dev)</u>
Annuals and Biennials	<b>2.52% (0.009)</b>	<b>7.70% (0.048)</b>
Cool-Season Grasses	<b>2.59% (0.008)</b>	<b>7.32% (0.014)</b>
Ephemeral Spring Forbs	<b>3.09% (0.022)</b>	<b>4.86% (0.017)</b>
Ferns	<b>0.49% (0.005)</b>	<b>1.61% (0.014)</b>
Grass-Like	<b>17.90% (0.112)</b>	<b>4.46% (0.006)</b>
Legumes	<b>11.81% (0.085)</b>	<b>11.79% (0.019)</b>
Spring Forbs	<b>4.71% (0.018)</b>	<b>13.45% (0.015)</b>
Summer/Fall Forbs	<b>15.00% (0.056)</b>	<b>22.61% (0.054)</b>
Warm-Season Grasses	<b>0.24% (0.001)</b>	<b>0.88% (0.005)</b>
Woody Species	<b>41.65% (0.076)</b>	<b>25.33% (0.053)</b>

**Table 2a. Plant Community Structure: Ground Cover.**

<u>Structural Component</u>	<u>Mean Percent Cover</u>
BARE SOIL	<b>5.97</b>
BARE ROCK	<b>16.50</b>
GRASS LITTER	<b>0.56</b>
WOODY DEBRIS	<b>10.19</b>
LEAF LITTER	<b>58.44</b>
UNVEGETATED SURFACE	<b>75.94</b>

**Table 2b. Plant Community Structure: Vegetation Type Cover.**

<u>Vegetation Type</u>	<u>Mean Percent Cover</u>
Ferns and Fern Allies	<b>0.01</b>
Grasses/Grass-Like	<b>9.47</b>
Herbs	<b>14.14</b>
Shrubs	<b>13.51</b>
Woody Vines	<b>3.64</b>

**Table 3a. Plant Community Composition: Herbaceous and Shrub Species.**

<b>Species</b>	<b>Common Name</b>	<b>Frequency</b>	<b>Mean Cover</b>	<b>Importance Value</b>
CAREX SPP		100.00%	8.41	0.1103
SYMPHORICARPOS ORBICULATUS	Coralberry	87.50%	7.84	0.0914
RUBUS SPP		50.00%	6.42	0.0575
PARTHENOCISSUS QUINQUEFOLIA	Virginia-creeper, woodbine	100.00%	2.55	0.0555
AGERATINA ALTISSIMA	Tall ageratina	67.50%	3.41	0.0449
RHUS AROMATICA	Squaw-bush	35.00%	7.82	0.0373
DESMODIUM OBTUSUM	Tick-trefoil	55.00%	2.39	0.0320
AMPHICARPA BRACTEATA	Hog-peanut	80.00%	1.28	0.0314
VITIS SPP		90.00%	0.78	0.0292
DESMODIUM GLUTINOSUM	Cluster-leaf tick-trefoil	45.00%	2.28	0.0270
PODOPHYLLUM PELTATUM	May-apple, mandrake	55.00%	1.41	0.0239
AGRIMONIA PUBESCENS	Downy agrimony, harvest	75.00%	0.67	0.0237
RIBES MISSOURIENSE	Missouri gooseberry	62.50%	0.60	0.0198
GALIAM CONCINNUM	Bedstraw, cleavers	52.50%	0.98	0.0182
GALIAM PILOSUM	Beadstraw, Cleavers	60.00%	0.50	0.0173
ELEPHANTOPUS CAROLINIANUS	Leafy elephant's foot	27.50%	3.82	0.0162
FESTUCA SUBVERTICILLATA	Nodding fescue	47.50%	0.63	0.0148
GEUM CANADENSE	White avens	52.50%	0.50	0.0148
THALICTRUM THALICTROIDES	Meadow-rue	55.00%	0.50	0.0145
ACALYPHA VIRGINICA	Virginia copperleaf	50.00%	0.50	0.0136
VIOLA PALMATA VAR. TRILOBA	Wood violet	42.50%	0.50	0.0128
HELIANTHUS HIRSUTUS	Hairy sunflower	32.50%	0.88	0.0116
PHRYMA LEPTOSTACHYA	Lopseed	40.00%	0.50	0.0115
SMILAX TAMNOIDES	Catbrier	40.00%	0.50	0.0110
DANTHONIA SPICATA	Poverty oatgrass	35.00%	0.68	0.0107
VIOLA SORORIA	Violet	37.50%	0.50	0.0099
SIDEROXYLON LANUGINOSUM SSP. ALBICANS	Carolina Gum	30.00%	0.50	0.0094
ARISTOLOCHIA SERPENTARIA	Snakeroot	30.00%	0.50	0.0086
RUELLIA STREPENS	Acanthus	27.50%	0.50	0.0085
BOTRYCHIUM VIRGINIANUM	Rattlesnake-fern	25.00%	0.50	0.0081
PRENANTHES ALTISSIMA	Tall white lettuce	30.00%	0.50	0.0080
VERNONIA BALDWINII	Western ironweed	32.50%	0.50	0.0080
SOLIDAGO ULMIFOLIA	Elm-leaved goldenrod	25.00%	0.50	0.0074
CIRSIIUM ALTISSIMUM	Tall thistle	30.00%	0.50	0.0073
SANICULA CANADENSIS	Canada sanicle	25.00%	0.50	0.0070

<b>Species</b>	<b>Common Name</b>	<b>Frequency</b>	<b>Mean Cover</b>	<b>Importance Value</b>
DESMODIUM ROTUNDIFOLIUM	Round-leaved tick-trefoil	17.50%	1.21	0.0069
TRIODANIS PERFOLIATA	Round-leaved triodanis	25.00%	0.75	0.0066
LESPEDEZA VIRGINICA	Virginia lespedeza	22.50%	0.50	0.0065
LESPEDEZA PROCUMBENS	Downy trailing lespedeza	25.00%	0.50	0.0064
DICHANTHELIUM OLIGOSANTHES	Panic grass	25.00%	0.50	0.0063
DICHANTHELIUM VILLOSISSIMUM	Panic grass	22.50%	0.50	0.0062
VAR. VILLOSISSIMUM				
CONVOLVULUS ARVENSIS	Field-bindweed	15.00%	0.92	0.0049
MUHLENBERGIA SCHREBERI	Nimblewill	15.00%	0.50	0.0044
VIBURNUM RUFIDULUM	Southern black haw	15.00%	0.50	0.0043
EUPHORBIA COROLLATA	Flowering spurge	15.00%	0.50	0.0042
MENISPERMUM CANADENSE	Moonseed	12.50%	0.50	0.0039
OXALIS SPP	wood-sorrel	15.00%	0.50	0.0039
STELLARIA MEDIA	Common chickweed	15.00%	0.92	0.0037
AMORPHA CANESCENS	Lead-plant	12.50%	0.50	0.0037
MONARDA RUSSELIANA	Bee-balm	12.50%	0.50	0.0036
ASTER PATENS	Clasping wild aster	12.50%	0.50	0.0036
HOUSTONIA PURPUREA	Mountain houstonia	10.00%	0.50	0.0034
AMBROSIA ARTEMISIIFOLIA	Common ragweed	12.50%	0.50	0.0033
LAMIUM PURPUREUM	Red dead nettle	15.00%	0.50	0.0033
PHYSALIS VIRGINIANA	Virginia ground cherry	10.00%	0.50	0.0031
LACTUCA CANADENSIS	Tall lettuce	10.00%	0.50	0.0030
CELASTRUS SCANDENS	American bittersweet	12.50%	0.50	0.0030
DICHANTHELIUM LINEARIFOLIUM	Panic grass	10.00%	0.50	0.0030
SOLIDAGO PETIOLARIS	Goldenrod	10.00%	0.50	0.0029
AGRIMONIA ROSTELLATA	Woodland agrimony,	10.00%	0.50	0.0029
TOXICODENDRON RADICANS	Common poison-ivy	10.00%	0.50	0.0025
BROMUS PUBESCENS	Brome, Brome-grass, Chess,	7.50%	0.50	0.0024
BIDENS BIPINNATA	Spanish Needles	10.00%	0.50	0.0024
GALIUM APARINE	Cleavers	5.00%	1.75	0.0023
DESMODIUM PANICULATUM	Tick-trefoil	7.50%	0.50	0.0022
TRIOSTEUM PERFOLIATUM	Perfoliate horse-gentian	10.00%	0.50	0.0022
HIERACIUM GRONOVII	Beaked hawkweed	7.50%	0.50	0.0022
ASTER TURBINELLUS	Prairie wild aster	7.50%	0.50	0.0022
SCUTELLARIA PARVULA	Little skullcap	7.50%	0.50	0.0020
LESPEDEZA REPENS	Creeping lespedeza	7.50%	0.50	0.0020
ELYMUS VIRGINICUS	Virginia wild rye	7.50%	0.50	0.0020
AMPHIACHYRIS	Broomweed	2.50%	3.00	0.0019
DRACUNCULOIDES				
TRADESCANTIA THARPII	Spiderwort	7.50%	0.50	0.0018
DICHANTHELIUM	Panic grass	7.50%	0.50	0.0016
MALACOPHYLLUM				
ASPLENIUM PLATYNEURON	Ebony spleenwort	7.50%	0.50	0.0016
VERONICA ARVENSIS	Corn speedwell	7.50%	0.50	0.0016
POLYGONUM SCANDENS	False buckwheat	5.00%	0.50	0.0015
ANTENNARIA PLANTAGINIFOLIA	Plantain pussytoes	5.00%	0.50	0.0015
ALLIUM CANADENSE	Onion	5.00%	0.50	0.0014
POTENTILLA SIMPLEX	Old-field five-fingers	5.00%	0.50	0.0013
ANEMONE VIRGINIANA	Tall anemone, thimbleweed	5.00%	0.50	0.0011
TRIDENS FLAVUS	Purpletop	5.00%	0.50	0.0011

Species	Common Name	Frequency	Mean Cover	Importance Value
MONARDA FISTULOSA	Wild bergamot	5.00%	0.50	0.0011
VALERIANELLA RADIATA	Corn salad	5.00%	0.50	0.0011
POLYGONUM SPP		2.50%	0.50	0.0008
LONICERA JAPONICA	Japanese honeysuckle	2.50%	0.50	0.0008
ROSA SETIGERA	Climbing prairie rose	2.50%	0.50	0.0008
DICHANTHELIUM CLANDESTINUM	Panic grass	2.50%	0.50	0.0008
DESMODIUM PAUCIFLORUM	Few-flowered tick-trefoil	2.50%	0.50	0.0008
GALIUM TRIFLORUM	Sweet-scented bedstraw	2.50%	0.50	0.0008
GALIUM TRIFIDUM	Northern three-lobed	2.50%	0.50	0.0008
VERBESINA ALTERNIFOLIA	Wingstem	2.50%	0.50	0.0008
VERBENA URTICIFOLIA	White vervain	2.50%	0.50	0.0008
TRILLIUM SESSILE	Toadshade	2.50%	0.50	0.0007
CEANOTHUS AMERICANUS	New Jersey tea, redroot	2.50%	0.50	0.0007
KRIGIA BIFLORA	Orange dwarf dandelion	2.50%	0.50	0.0007
POA WOLFII	Bluegrass	2.50%	0.50	0.0007
ERECTHITES HIERACIIFOLIA	Fireweed	2.50%	0.50	0.0007
TRADESCANTIA OHIENSIS	Smooth spiderwort	2.50%	0.50	0.0005
HEUCHERA RICHARDSONII	Prairie alum-root	2.50%	0.50	0.0005
ARABIS CANADENSIS	Sickle-pod	2.50%	0.50	0.0005
THALICTRUM DASYPARPUM	Purple meadow-rue	2.50%	0.50	0.0005
GALACTIA VOLUBILIS	downy milkpea	2.50%	0.50	0.0005
DESMODIUM SPP		2.50%	0.50	0.0005
ROSA CAROLINA	Pasture rose	2.50%	0.50	0.0005
PRENANTHES ASPERA	Rough white lettuce	2.50%	0.50	0.0005
WOODSIA OBTUSA	Blunt cliff fern	2.50%	0.50	0.0005
FRAGARIA VIRGINIANA	Thick-leaved wild	2.50%	0.50	0.0005
TRADESCANTIA BRACTEATA	Sticky spiderwort	2.50%	0.50	0.0005

**Table 3b. Plant Community Composition: Exotic Species.**

Species	Common Name	Frequency	Mean Cover	Importance Value
CONVOLVULUS ARVENSIS	Field-bindweed	15.00%	0.92%	0.0049
STELLARIA MEDIA	Common chickweed	15.00%	0.92%	0.0037
LAMIUM PURPUREUM	Red dead nettle	15.00%	0.50%	0.0033
VERONICA ARVENSIS	Corn speedwell	7.50%	0.50%	0.0016
LONICERA JAPONICA	Japanese honeysuckle	2.50%	0.50%	0.0008



## 2003 Manley Woods Ground Flora Vegetation

**Table 1a. Plant Community Composition: Species Richness and Shannon Diversity.**

All Species:

Species Richness:	<b>106</b>	Total Shannon Evenness:	<b>0.68</b>
Total Shannon Diversity:	<b>3.19</b>	Mean Evenness (st dev):	<b>0.72 (0.03)</b>
Mean Diversity (st dev):	<b>2.85 (0.20)</b>		

Native Species Only:

Native Species Richness:	<b>97</b>	Total Shannon Evenness:	<b>0.68</b>
Total Shannon Diversity:	<b>3.12</b>	Mean Evenness (st dev):	<b>0.72 (0.04)</b>
Mean Diversity (st dev):	<b>2.80 (0.19)</b>		

**Table 1b. Plant Community Summary: Relative Frequency and Cover of Exotic Species.**

Number of Exotic Species: **8**

Number of Native Species: **97**

Exotic Ratio: **0.076**

	<u>Mean Relative Frequency</u>	<u>Mean Relative Cover</u>
Exotic	<b>3.53%</b>	<b>1.52%</b>
Native	<b>96.47%</b>	<b>98.48%</b>

**Table 1c. Plant Community Composition: Relative Frequency and Cover of Plant Guilds.**

<u>Plant Guild</u>	<u>Mean Relative Cover (st dev)</u>	<u>Mean Relative Frequency (st dev)</u>
Annuals and Biennials	<b>2.90% (0.016)</b>	<b>7.26% (0.037)</b>
Cool-Season Grasses	<b>2.64% (0.008)</b>	<b>5.38% (0.004)</b>
Ephemeral Spring Forbs	<b>2.02% (0.010)</b>	<b>4.56% (0.018)</b>
Ferns	<b>0.36% (0.003)</b>	<b>0.92% (0.007)</b>
Grass-Like	<b>7.13% (0.025)</b>	<b>5.75% (0.014)</b>
Legumes	<b>14.84% (0.058)</b>	<b>14.52% (0.019)</b>
Spring Forbs	<b>4.22% (0.009)</b>	<b>9.80% (0.029)</b>
Summer/Fall Forbs	<b>15.77% (0.086)</b>	<b>22.40% (0.047)</b>
Warm-Season Grasses	<b>0.33% (0.002)</b>	<b>0.84% (0.004)</b>
Woody Species	<b>49.79% (0.118)</b>	<b>28.58% (0.080)</b>

**Table 2a. Plant Community Structure: Ground Cover.**

<u>Structural Component</u>	<u>Mean Percent Cover</u>
BARE SOIL	<b>5.89</b>
BARE ROCK	<b>10.82</b>
GRASS LITTER	<b>2.11</b>
WOODY DEBRIS	<b>24.66</b>
LEAF LITTER	<b>57.14</b>
UNVEGETATED SURFACE	<b>91.31</b>

**Table 2b. Plant Community Structure: Vegetation Type Cover.**

<u>Vegetation Type</u>	<u>Mean Percent Cover</u>
Ferns and Fern Allies	<b>0.01</b>
Grasses/Grass-Like	<b>2.26</b>
Herbs	<b>9.31</b>
Shrubs	<b>9.14</b>
Trees	<b>0.01</b>
Woody Vines	<b>1.59</b>

**Table 3a. Plant Community Composition: Herbaceous and Shrub Species.**

<b>Species</b>	<b>Common Name</b>	<b>Frequency</b>	<b>Mean Cover</b>	<b>Importance Value</b>
SYMPHORICARPOS ORBICULATUS	Coralberry	85.00%	7.74	0.1724
CAREX SPP		95.00%	1.68	0.0627
PARTHENOCISSUS QUINQUEFOLIA	Virginia-creeper, woodbine	100.00%	1.00	0.0513
RHUS AROMATICA	Squaw-bush	35.00%	3.64	0.0430
AMPHICARPA BRACTEATA	Hog-peanut	70.00%	1.21	0.0382
VITIS SPP		87.50%	0.50	0.0358
ELEPHANTOPUS CAROLINIANUS	Leafy elephant's foot	22.50%	5.44	0.0332
RUBUS SPP		47.50%	1.66	0.0317
AGRIMONIA PUBESCENS	Downy agrimony, harvest	60.00%	0.92	0.0286
DESMODIUM GLUTINOSUM	Cluster-leaf tick-trefoil	37.50%	2.30	0.0285
RIBES MISSOURIENSE	Missouri gooseberry	50.00%	0.63	0.0223
DESMODIUM OBTUSUM	Tick-trefoil	22.50%	2.94	0.0205
GALIUM PILOSUM	Beadstraw, Cleavers	50.00%	0.50	0.0196
DESMODIUM PERPLEXUM	perplexed ticktrefoil	32.50%	1.27	0.0193
PODOPHYLLUM PELTATUM	May-apple, mandrake	42.50%	0.65	0.0187
AGERATINA ALTISSIMA	Tall ageratina	35.00%	0.86	0.0177
PHRYMA LEPTOSTACHYA	Lopseed	42.50%	0.50	0.0168
VERNONIA BALDWINII	Western ironweed	42.50%	0.50	0.0163
THALICTRUM THALICTROIDES	Meadow-rue	37.50%	0.50	0.0133
FESTUCA SUBVERTICILLATA	Nodding fescue	30.00%	0.71	0.0129
VIOLA SORORIA	Violet	35.00%	0.50	0.0124
SANICULA CANADENSIS	Canada sanicle	27.50%	0.50	0.0106
DESMODIUM ROTUNDIFOLIUM	Round-leaved tick-trefoil	22.50%	0.78	0.0104
GALIUM CONCINNUM	Bedstraw, cleavers	27.50%	0.50	0.0103
GEUM CANADENSE	White avens	27.50%	0.50	0.0102
GALIUM APARINE	Cleavers	25.00%	0.50	0.0099
HELIANTHUS HIRSUTUS	Hairy sunflower	25.00%	0.50	0.0099
SOLIDAGO ULMIFOLIA	Elm-leaved goldenrod	20.00%	0.81	0.0091
DESMODIUM PANICULATUM	Tick-trefoil	25.00%	0.50	0.0091
SMILAX TAMNOIDES	Catbrier	22.50%	0.50	0.0087
VIOLA PALMATA VAR. TRILOBA	Wood violet	20.00%	0.50	0.0082
ACALYPHA VIRGINICA	Virginia copperleaf	20.00%	0.50	0.0082
DANTHONIA SPICATA	Poverty oatgrass	20.00%	0.50	0.0080
ARISTOLOCHIA SERPENTARIA	Snakeroot	20.00%	0.50	0.0078
SIDEROXYLON LANUGINOSUM SSP. ALBICANS	Carolina Gum	17.50%	0.50	0.0073
TRIODANIS PERFOLIATA	Round-leaved triodanis	17.50%	0.50	0.0065

Species	Common Name	Frequency	Mean Cover	Importance Value
LESPEDEZA VIRGINICA	Virginia lespedeza	15.00%	0.50	0.0060
LACTUCA FLORIDANA	Woodland Lettuce	15.00%	0.50	0.0059
LAMIUM PURPUREUM	Red dead nettle	17.50%	0.50	0.0054
STELLARIA MEDIA	Common chickweed	15.00%	0.50	0.0052
ARENARIA SERPYLLIFOLIA	Thyme leaf sandwort	15.00%	0.50	0.0052
MONARDA RUSSELIANA	Bee-balm	12.50%	0.50	0.0046
DICHANTHELIUM OLIGOSANTHES	Panic grass	10.00%	0.50	0.0042
ANTENNARIA PLANTAGINIFOLIA	Plantain pussytoes	5.00%	1.75	0.0042
DICHANTHELIUM SPP		12.50%	0.50	0.0039
TORILIS JAPONICA	Japanese hedge-parsley	10.00%	0.50	0.0036
ASTER PATENS	Clasping wild aster	7.50%	0.50	0.0036
PHYSALIS VIRGINIANA	Virginia ground cherry	7.50%	0.50	0.0036
AGRIMONIA ROSTELLATA	Woodland agrimony,	7.50%	0.50	0.0034
LESPEDEZA REPENS	Creeping lespedeza	7.50%	0.50	0.0034
LESPEDEZA PROCUMBENS	Downy trailing lespedeza	10.00%	0.50	0.0033
TRIOSTEUM PERFOLIATUM	Perfoliate horse-gentian	10.00%	0.50	0.0031
VIBURNUM RUFIDULUM	Southern black haw	7.50%	0.50	0.0030
HOUSTONIA PURPUREA	Mountain houstonia	7.50%	0.50	0.0030
BOTRYCHIUM VIRGINIANUM	Rattlesnake-fern	7.50%	0.50	0.0030
RUELLIA STREPENS	Acanthus	7.50%	0.50	0.0029
ANEMONE VIRGINIANA	Tall anemone, thimbleweed	7.50%	0.50	0.0029
LESPEDEZA VIOLACEA	Violet lespedeza	5.00%	1.75	0.0028
DICHANTHELIUM LINEARIFOLIUM	Panic grass	5.00%	0.50	0.0026
VERONICA ARVENSIS	Corn speedwell	7.50%	0.50	0.0025
ASPLENIUM PLATYNEURON	Ebony spleenwort	7.50%	0.50	0.0023
VALERIANELLA RADIATA	Corn salad	7.50%	0.50	0.0023
DICHANTHELIUM CLANDESTINUM	Panic grass	2.50%	3.00	0.0023
POLYGONUM SCANDENS	False buckwheat	5.00%	0.50	0.0021
AMBROSIA ARTEMISIIFOLIA	Common ragweed	5.00%	0.50	0.0021
MUHLENBERGIA SOBOLIFERA	Muhly	5.00%	0.50	0.0021
DICHANTHELIUM VILLOSISSIMUM	Panic grass	5.00%	0.50	0.0020
VAR. VILLOSISSIMUM				
SOLIDAGO PETIOLARIS	Goldenrod	5.00%	0.50	0.0019
ASTER TURBINELLUS	Prairie wild aster	5.00%	0.50	0.0019
EUPHORBIA COROLLATA	Flowering spurge	5.00%	0.50	0.0019
ELYMUS VIRGINICUS	Virginia wild rye	5.00%	0.50	0.0019
VERBESINA ALTERNIFOLIA	Wingstem	5.00%	0.50	0.0018
CIRSIIUM ALTISSIMUM	Tall thistle	5.00%	0.50	0.0016
TRIDENS FLAVUS	Purpletop	5.00%	0.50	0.0016
ROSA CAROLINA	Pasture rose	5.00%	0.50	0.0016
PRENANTHES ALTISSIMA	Tall white lettuce	5.00%	0.50	0.0016
RUELLIA HUMILIS	Fringeleaf ruellia	2.50%	0.50	0.0013
DIOSPYROS VIRGINIANA	Persimmon	2.50%	0.50	0.0013
ERIGERON SPP		2.50%	0.50	0.0013
TRIFOLIUM CAMPESTRE	Pinnate hop-clover	2.50%	0.50	0.0013
MENISPERMUM CANADENSE	Moonseed	2.50%	0.50	0.0010
ROSA SETIGERA	Climbing prairie rose	2.50%	0.50	0.0010
MUHLENBERGIA SCHREBERI	Nimblewill	2.50%	0.50	0.0010
BROMUS PUBESCENS	Brome, Brome-grass, Chess,	2.50%	0.50	0.0010

Species	Common Name	Frequency	Mean Cover	Importance Value
RANUNCULUS HISPIDUS	Hispid buttercup	2.50%	0.50	0.0010
CIRSIIUM SPP		2.50%	0.50	0.0010
DESMODIUM PAUCIFLORUM	Few-flowered tick-trefoil	2.50%	0.50	0.0010
CEANOTHUS AMERICANUS	New Jersey tea, redroot	2.50%	0.50	0.0010
TOXICODENDRON RADICANS	Common poison-ivy	2.50%	0.50	0.0010
LACTUCA SERRIOLA	Prickly lettuce	2.50%	0.50	0.0010
SOLIDAGO SPP		2.50%	0.50	0.0010
ANDROPOGON GERARDII	Big bluestem	2.50%	0.50	0.0010
ROSA MULTIFLORA	Multiflora rose	2.50%	0.50	0.0010
HIERACIUM GRONOVII	Beaked hawkweed	2.50%	0.50	0.0010
TRADESCANTIA THARPII	Spiderwort	2.50%	0.50	0.0008
TRADESCANTIA OHIENSIS	Smooth spiderwort	2.50%	0.50	0.0008
CELASTRUS SCANDENS	American bittersweet	2.50%	0.50	0.0008
DESMODIUM CUSPIDATUM	Big tick-trefoil	2.50%	0.50	0.0008
SOLANUM CAROLINENSE	Horse-nettle	2.50%	0.50	0.0008
SCUTELLARIA PARVULA	Little skullcap	2.50%	0.50	0.0008
ERIGERON STRIGOSUS	Rough fleabane	2.50%	0.50	0.0008
LACTUCA CANADENSIS	Tall lettuce	2.50%	0.50	0.0008
Parietaria pensylvanica	Pennsylvania pellitory	2.50%	0.50	0.0008
OXALIS SPP	wood-sorrel	2.50%	0.50	0.0008
WOODSIA OBTUSA	Blunt cliff fern	2.50%	0.50	0.0008
SOLIDAGO HISPIDA VAR. HISPIDA	Hairy Goldenrod	2.50%	0.50	0.0008

**Table 3b. Plant Community Composition: Exotic Species.**

Species	Common Name	Frequency	Mean Cover	Importance Value
LAMIUM PURPUREUM	Red dead nettle	17.50%	0.50%	0.0054
STELLARIA MEDIA	Common chickweed	15.00%	0.50%	0.0052
ARENARIA SERPYLLIFOLIA	Thyme leaf sandwort	15.00%	0.50%	0.0052
TORILIS JAPONICA	Japanese hedge-parsley	10.00%	0.50%	0.0036
VERONICA ARVENSIS	Corn speedwell	7.50%	0.50%	0.0025
TRIFOLIUM CAMPESTRE	Pinnate hop-clover	2.50%	0.50%	0.0013
ROSA MULTIFLORA	Multiflora rose	2.50%	0.50%	0.0010
LACTUCA SERRIOLA	Prickly lettuce	2.50%	0.50%	0.0010